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HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)  
ISS Utilisation (3)

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INTERNATIONAL SPACE STATION AS ANALOG OF INTERPLANETARY TRANSIT VEHICLE  
FOR BIOMEDICAL RESEARCH

**Abstract**

Astronaut missions lasting up to six months aboard the International Space Station (ISS) have much in common with interplanetary flights, especially the outbound, Earth-to-Mars transit portion of a Mars mission. Utilization of ISS and other appropriate platforms to prepare for crewed expeditions to planetary destinations including Mars has been the work of NASA's Human Research Program (HRP) since 2005. HRP is charged specifically to understand and reduced the risks to astronaut health and performance in space exploration missions: everything HRP does and has done is directly related to that responsibility. Two major categories of human research have capitalized on ISS capabilities.

The first category centers on the biomedical aspects of long-duration exposure to spaceflight factors, including prolonged weightlessness, radiation exposure, isolation and confinement, and actual risk to life and limb. These studies contribute to astronaut safety, health and efficiency on any long-duration missions, whether in low Earth orbit (LEO) or beyond. Qualitatively, weightlessness is weightlessness, whether in LEO or en route to Mars. The HRP sponsors investigations into losses in muscle and bone integrity, cardiovascular function, sensory-motor capability, immune capacity and psychosocial health, and development and demonstration of appropriate treatments and preventative measures.

The second category includes studies that are focused on planetary expeditions beyond LEO. For these, ISS offers a high fidelity analog to investigate the combined effects of spaceflight factors (described above) plus the isolation and autonomy associated with simulated increasing distance from Earth. Investigations address crew cohesion, performance and workload, and mission control performance. The behavioral health and performance and space human factors aspects of planetary missions dominate this category. Work has already begun on a new investigation in this category which will examine the effects of a simulated lag in communications (mimicking that expected in transit to Mars) on astronaut performance aboard ISS.

Extension of the current ISS increment duration from six months to nine or even twelve months would provide opportunities for expanded research relevant to long duration missions, albeit at the cost of fewer astronauts as subjects for those investigations. Given the possible limited access to ISS after 2020, if ISS is intended to facilitate future exploration missions, then the in-flight human investigations should focus on those that clearly enable future exploration missions.